Augmented & Virtual Reality the UITS Advanced Visualization Lab

(for the digital arts & humanities at Indiana University)

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Digital Arts and Humanities Workshop Series – Spring 2018

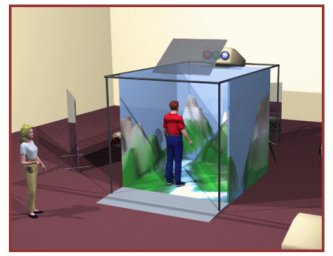
Fridays @ noon -- Scholars Commons IQ-Wall

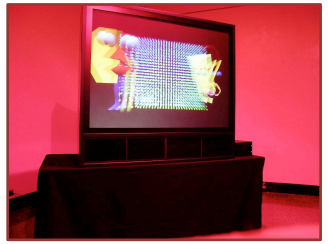
Date	Topic	Presenter
Jan. 12	Intro to Digital Humanities	Tassie Gniady
Jan. 19	Intro to Visualization	Michael Boyles
Jan. 26	Intro to R	Tassie Gniady
Feb. 2	Augmented Reality	Chauncey Frend
Feb. 9	Text Analysis of Kurt Vonnegut w/ the HathiTrust & Voyant	Tassie Gniady & Robert McDonald
Feb. 16	Virtual Reality	Bill Sherman
Feb. 23	R for Twitter	Tassie Gniady
Mar. 2	Advanced Media	Chris Eller
Mar. 23	Network Graphs	David Kloster
Mar. 30	3D Object Acquisition & Printing	Jeff Rogers
Apr. 6	3D Photogrammetry	Tassie Gniady
Apr. 13	IQ-Table & Touch-Enabled Software Workflows	David Reagan
Apr. 20	Omeka S and 3D Collections	Tassie Gniady & Will Cowan

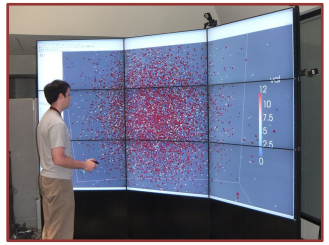
Goals for Today

- A bit of context: our organization and mission
- Getting acquainted with AR/VR
  - Academic Perspective
- AR
  - Brief History
  - How to use AR
  - IU & Elsewhere Examples
  - Making your own Augmented Reality
- VR
  - Reality Labs
  - How to use VR
  - Examples at IU
  - Advanced VR

About the Advanced Visualization Lab…

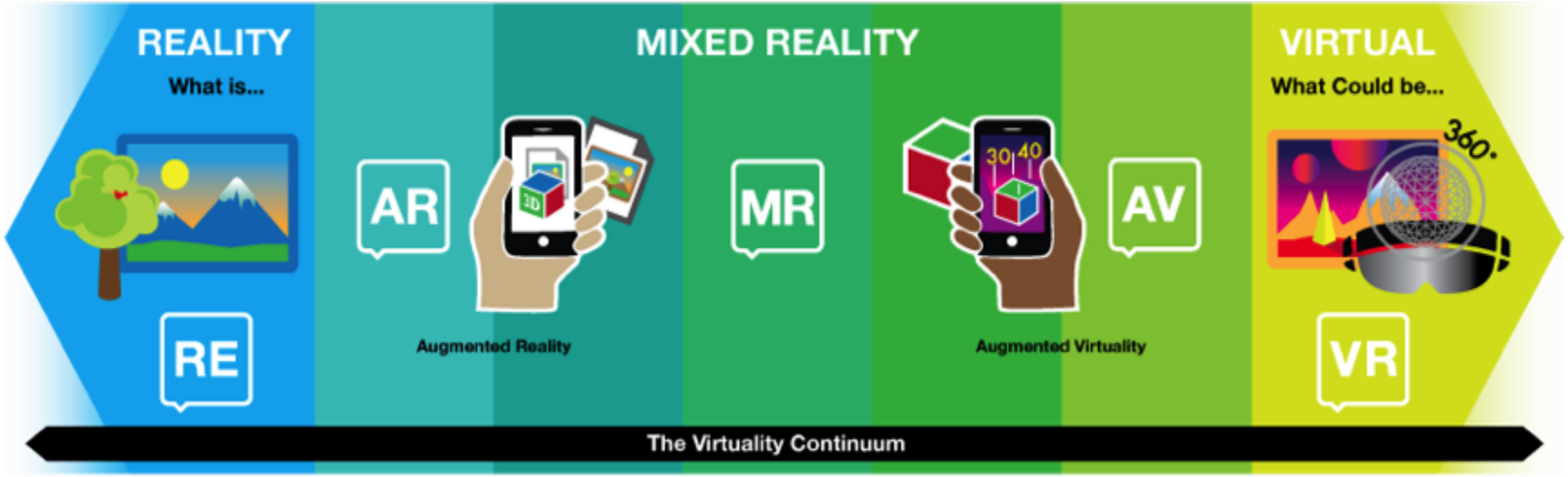






- Founded in 1997
  - Then: 4 staff; CAVE in Bloomington; ImmersaDesk @ IUPUI
  - Now: 8 staff; 2 flagship facilities; 20+ satellite facilities on 5 campuses
- Technology & support relevant to all 4 dimensions of IU's mission:
  - Research | Creative Activities | Education | Outreach
  - Support for all departments, disciplines, and campuses
- Growing & evolving
  - 1st decade – establishing capabilities & expertise – flagship facilities
  - 2nd decade – increasing access – distributed visualization initiatives
  - 3rd decade – increasing utilization – workflows, workshops, documentation

What is Augmented Reality?



Milgram, Paul, et al. "Augmented reality: A class of displays on the reality-virtuality continuum." *Photonics for industrial applications*. International Society for Optics and Photonics, 1995.

Photo Source: http://smartideasblog.trekk.com/augmented-or-virtual-how-do-you-like-your-reality

Brief History

- 1901 Lyman Frank Baum author of “The Master Key” imagines a kind of AR.
- 1968 Ivan Sutherland invents first head-mounted display “Sword-of-Damocles” at University of Utah.
- 1999 ARToolkit was created by Hirokazu Kato at HITLab
- 2010 Vuforia for AR Mobile Apps was released by Qualcomm.
- 2013 Google announces Google Glass.
- 2015 Microsoft announces the HoloLens.
- 2016 Niantic released Pokémon Go.

vuforia
by Qualcomm

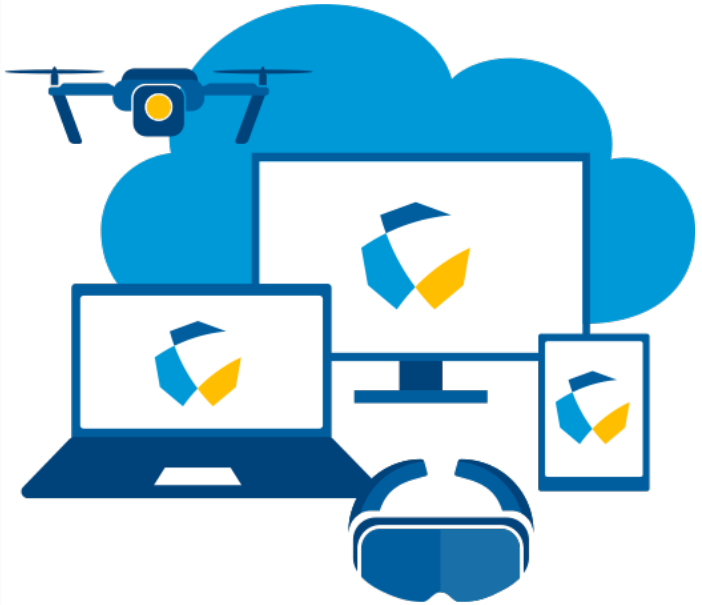
How to use AR Tools

Usage Type	AR Application	Data	Complexity
Type 1. Integrate existing AR applications and existing data into an existing curriculum or project.	Pre-existing	Pre-existing	**Easiest** Use free or paid AR application from App store, Android Store, or Microsoft Store.
Type 2. Use existing AR applications for viewing and interacting with your data	Pre-existing	Your	**Moderate but interesting** Use an existing AR application to view your data where the viewer will support tracking (Example: Image tracking in HP Reveal).
Type 3. Develop custom applications for viewing and interacting with your data	Your	Your	**Programming required** Build or extend an AR application to view your data where and how your wish.

AR Visualization Today: Experiences

WWF Free Rivers
World Wildlife Fund

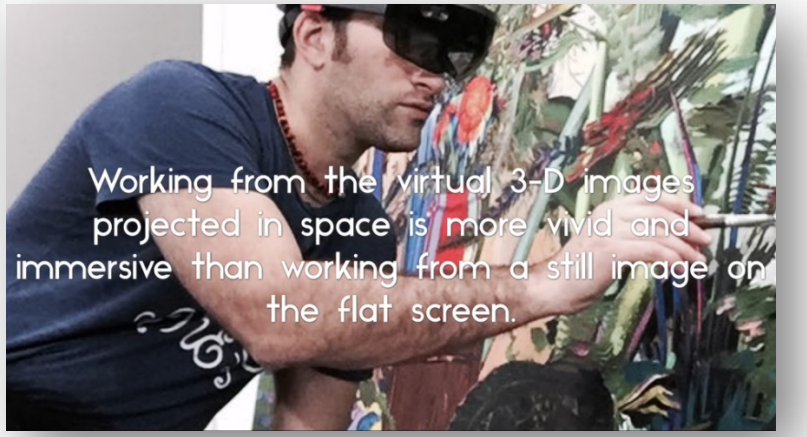
AR Visualization Today: Commercial



Trimble

AR today – at IU

Mechanical 2D to 3D Class Tool



"un plein air"

Traditional Painting with AR Reference

Holographic Gallery Art

Type 3: Your AR App + Your Data
&
Type 2: Pre-existing AR App + Your Data

AR Visualization Today: At IU

Using the HoloLens for prosthesis pre-visualization

Travis Bellicchi with Shirley Anderson wearing his prosthesis | PHOTO BY ABIGAIL WATSON

Mark Sporleder wearing his VFACS headset with an augmented nose prosthesis.

AR Platforms: BYOD or Emerging Platforms

User Owned/Provided (BYOD)

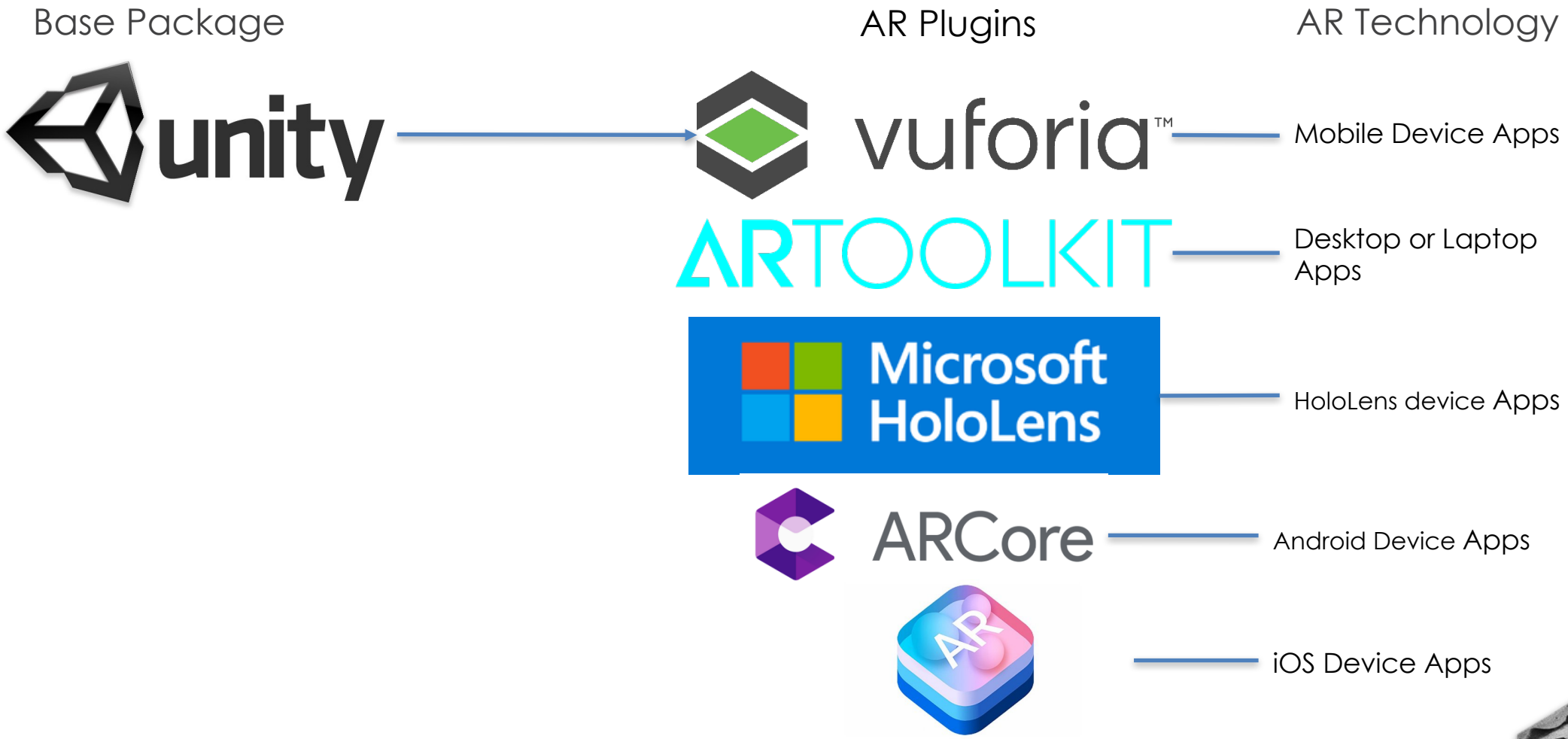
Emerging

Making your own Augmented Reality

REVEAL

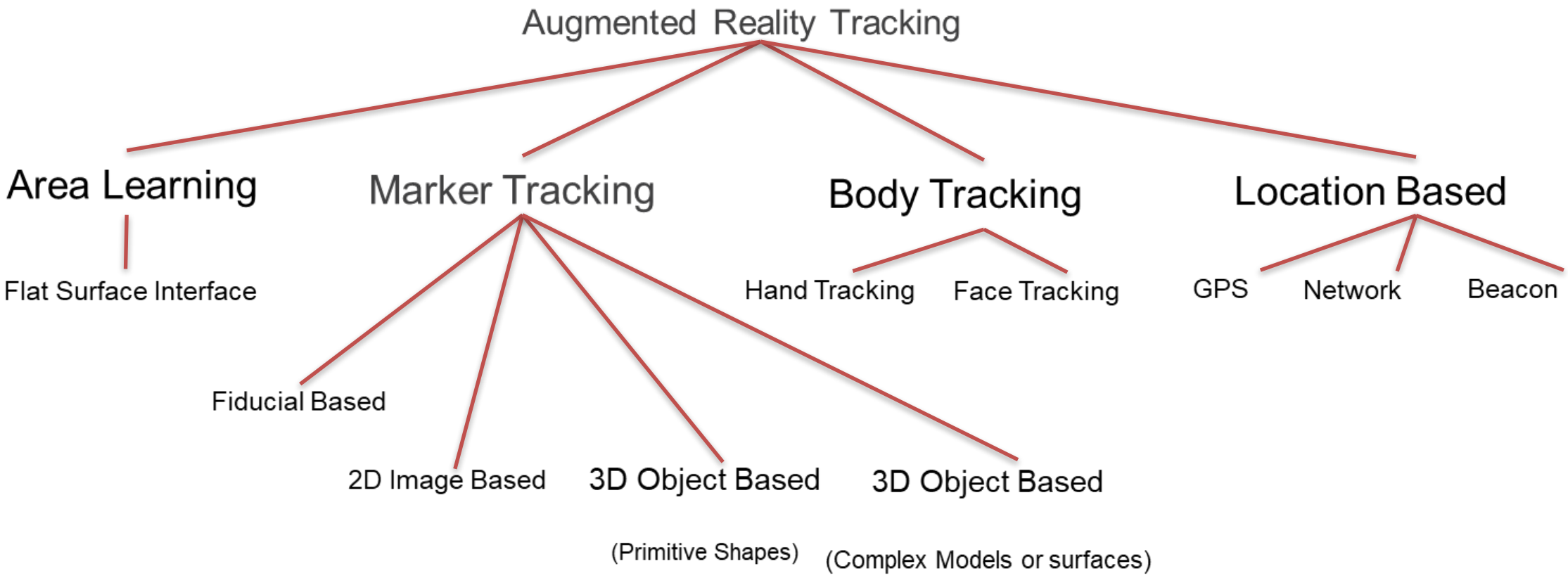
wikitude
See more.

AR Development Workflows



Analyst Breakdown: AR Tracking Systems

Initially **defining AR tracking requirements** for an application will inform which plugins and/or hardware tools are a good fit.



Area Learning (SLAM)

VR and Reality Labs

Reality Labs – Born from Collaboration

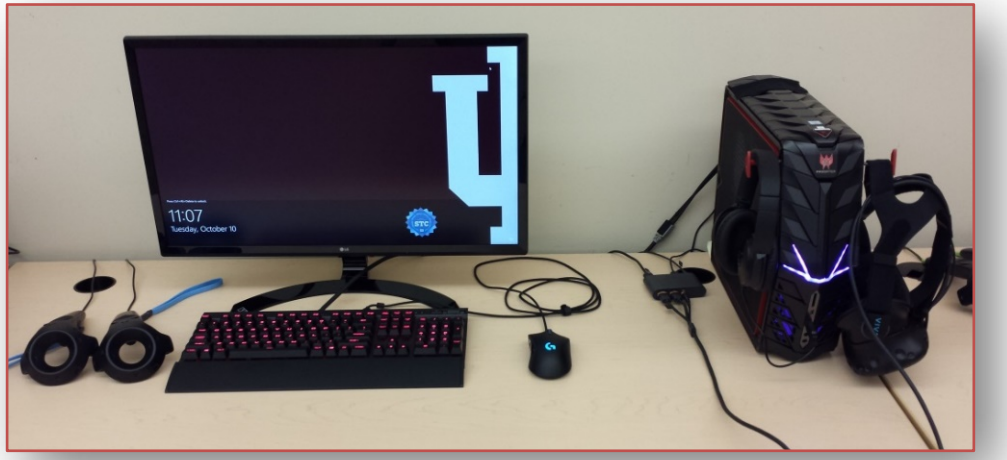
- Partnerships between RT & local IT Professionals

- Reality Labs are a win-win
  - Extends AVL's Distributed Visualization Initiative
  - An enterprise VR option for local IT Pros.
  - Each Reality Lab collaboration refines the overall model

- Why now?
  - Inexpensive VR hardware
  - Large and accessible VR software library

What are Reality Labs?

- Technology classrooms or research labs that contain some number of Reality Stations
- Hardware components of a Reality Station
  - VR equipment (tracked display + interface devices)
    - Currently prefer HTC Vive, but workflows support Oculus Rift too
  - VR-capable computer
    - Acer and now MSI
  - High-quality monitor
    - High refresh, 4K, and/or HDR



Reality Lab – software environment

Reality Stations are configured for VR, but are great for non-VR uses too...

<u>30+ Pre-installed Steam VR apps</u>

- Art & museum apps
- Simulations
- Media players
- Select games & experiences that demonstrate unique interfaces/capabilities of VR
- 600+ more VR apps available on steam

A representative Reality Lab

Where are Reality Labs?

- 12 Reality Labs open
- Distributed on 3 IU campuses
  - 45 stations in classrooms
  - 24 stations in lab spaces
- Pilot Reality Stations
  - 3 pilot stations in lab spaces
  - Local IT Professional testing
  - Community pilot testing

Location	*Type of Space*	*# of Stations*
School of Art, Architecture + Design, 2017	Classroom	1
Media School, 2017	Classroom	10
School of Art, Architecture + Design, 2017	Classroom	10
UITS Technology Park, 2017	Lab	2
NEXT Lab, 2017	Lab	4
Interface Lab, 2017	Lab	4
UITS 3D Print & Modeling Lab, 2017	Lab	6
School of Art, Architecture + Design DART Lab, 2018	Lab	2
School of Informatics & Computing, 2018	Classroom	6
School of Informatics & Computing, 2018	Classroom	8
UITS Idea Garden, coming fall 2018	Lab	2
Ruth Lilly Medical Library	Lab	4
IU East Hayes Hall HY024	Classroom	10

Similarly to AR, VR can be used of in the same way

Usage Type	VR Application	Data	Complexity
Type 1. Integrate existing VR applications and existing data into an existing curriculum	Pre-existing	Pre-existing	**Easiest** Use provided Reality Station with provided or available VR applications and sample data
Type 2. Use existing VR applications for viewing and interacting with your data	Pre-existing	Your	**Moderate but interesting** Capture or create your own data and use existing VR applications to view it
Type 3. Develop custom applications for viewing and interacting with your data	Your	Your	**Programming required** Use Unity (or similar tool) to create your VR environment or application and view your data

VR at IU

Human Origins and Prehistory class

"…we just finished discussing ancient New World civilizations. Each student should have a chance to see Monte Albán in Google Earth VR."

-- Alex Elvis Badillo, IUPUI Clinical Faculty & Ph.D Candidate

VR at IU

Interior spaces and furniture design

Jon Racek

IUB School of Art, Architecture + Design

VR at IU

Bethel Church

Historic site in Indianapolis

Currently funded by New Frontiers/New Currents Grant at IU

Virtual reconstruction & preservation

Zeb Wood, Albert William, Andrea Copeland

IUPUI School of Informatics and Computing

VR at IU

Many new VR applications developed in Reality Labs

Students, Faculty, and staff all creating

77 new VR apps created in Reality Labs within 18 months

Indianapolis AVL Supported Clients (14)
Beyond the Frame Class VR Video projects (12)
School of Fine Art and Design (27)
Introduction to VR Class (21)
AVL Staff Created Apps (3)

Reality Cage – Supporting Research into VR

Hardware

- Reality Station
- cy.PIPES controller
- 12' x 12' x 12' Truss

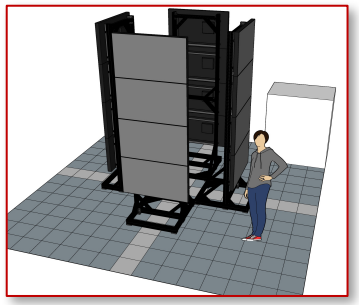
Capabilities

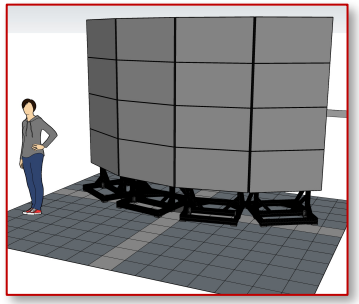
- Reconfigurable Mounting Scenarios
- Environmental feedback devices
- VR Simulation and Training black box space

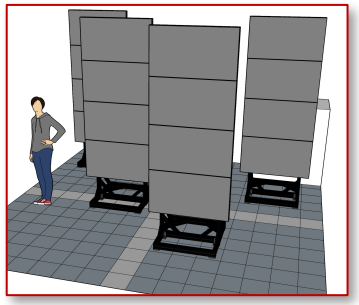
Flagship Facility – NEXT Lab

NEXT = New, Emerging, and eXperimental Technologies

NEXT Lab – Reconfigurable IQ-Wall







NEXT Lab – Sharing Content and Workflows

Thank You!

Contact Us

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Demos and Discussions

- Microsoft HoloLens
- Biomedical Training AR App
- Paleontology AR App
- Video Card AR App

AR YouTube Playlist